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F4H H3
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(54) Abstract Title
Self cooling beverage containers

(57) A self cooling beverage container or can may use the endothermic reaction between ammonium nitrate (40) and water (38). The two chemicals may be separated by a membrane (48), which may be ruptured eg by a rod (46) connected to the pull top of the can. Agitation means may be provided to mix the chemicals.

In another embodiment a volatile liquid is evaporated. In a further embodiment water is maintained in a low pressure environment and allowed to boil. The vapour which is produced from the boiling water is absorbed by a desiccant maintaining the boiling process. The cooling process may be initiated by the pressure release of a carbonated beverage can during opening of the can. The cooling process may rely on the Peltier effect.

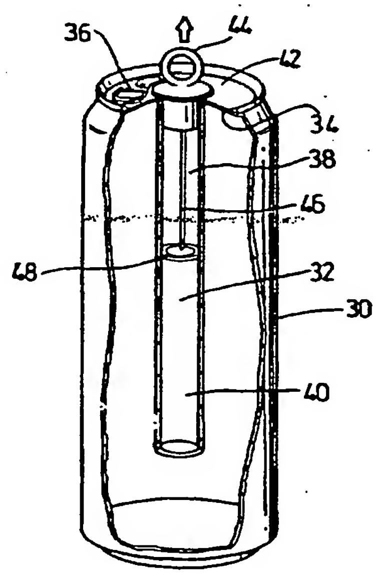

Fig. 3

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

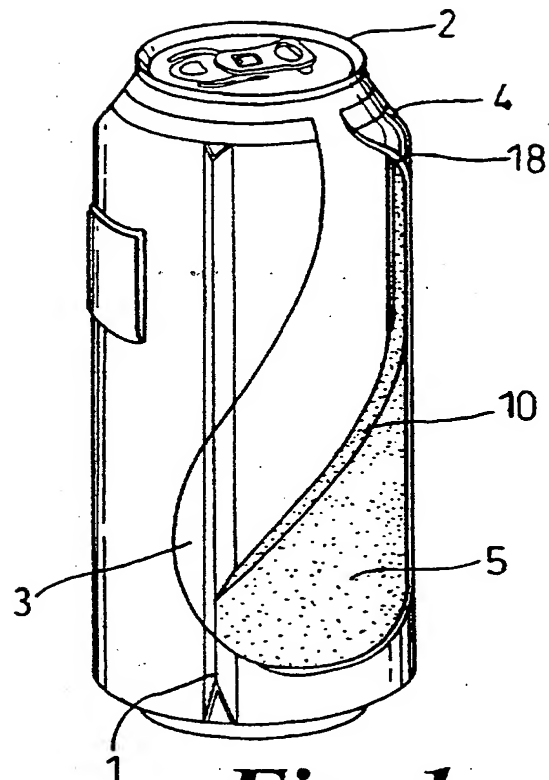

Fig. 1

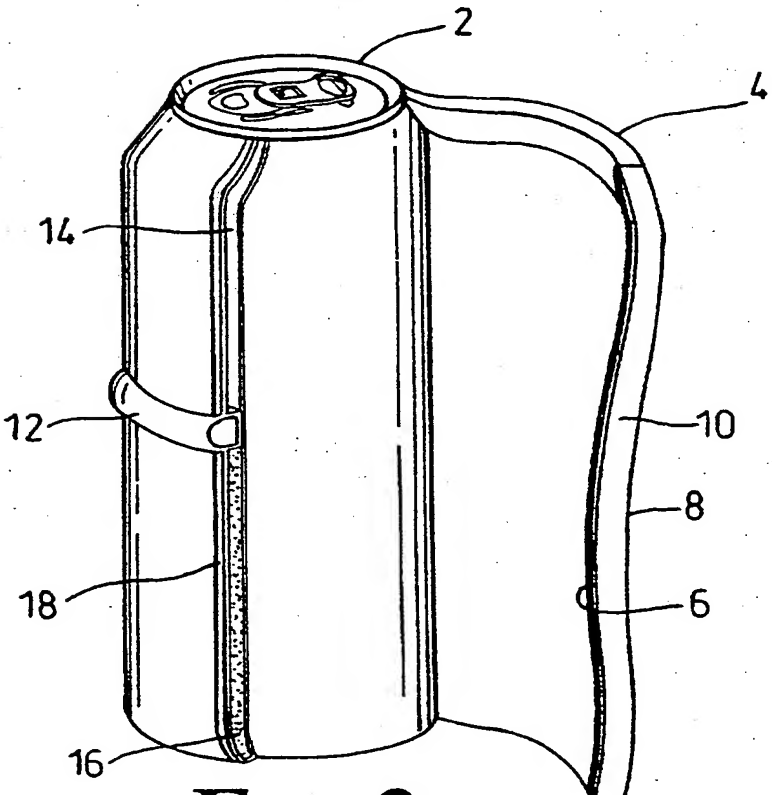

Fig. 2

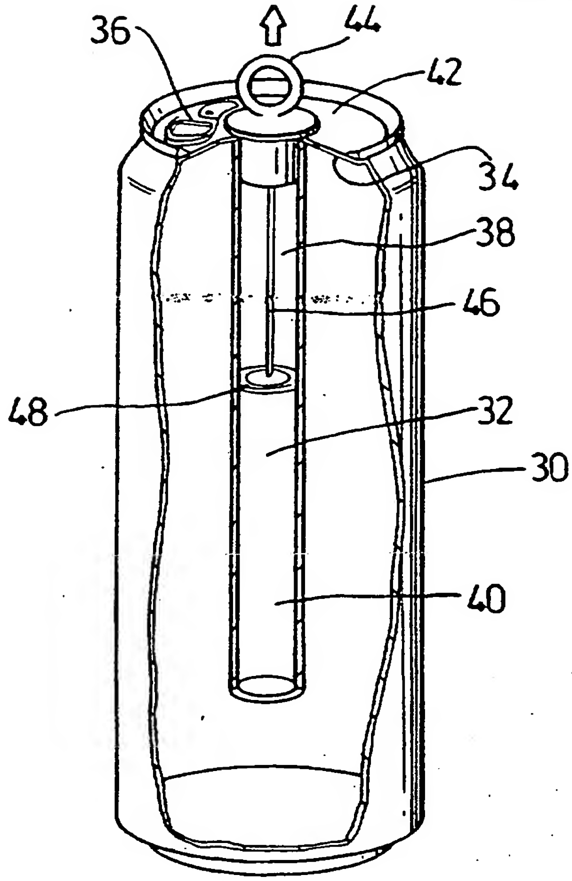

Fig. 3

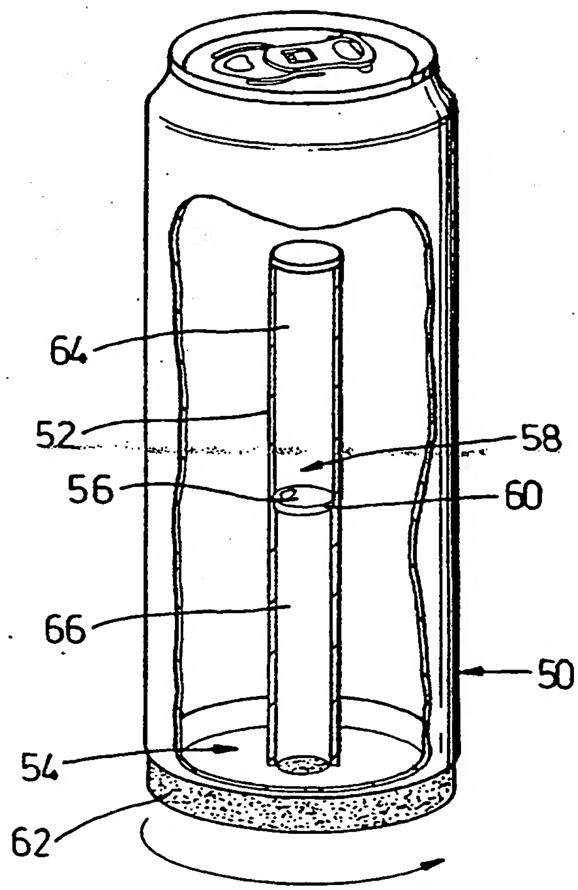

Fig. 4

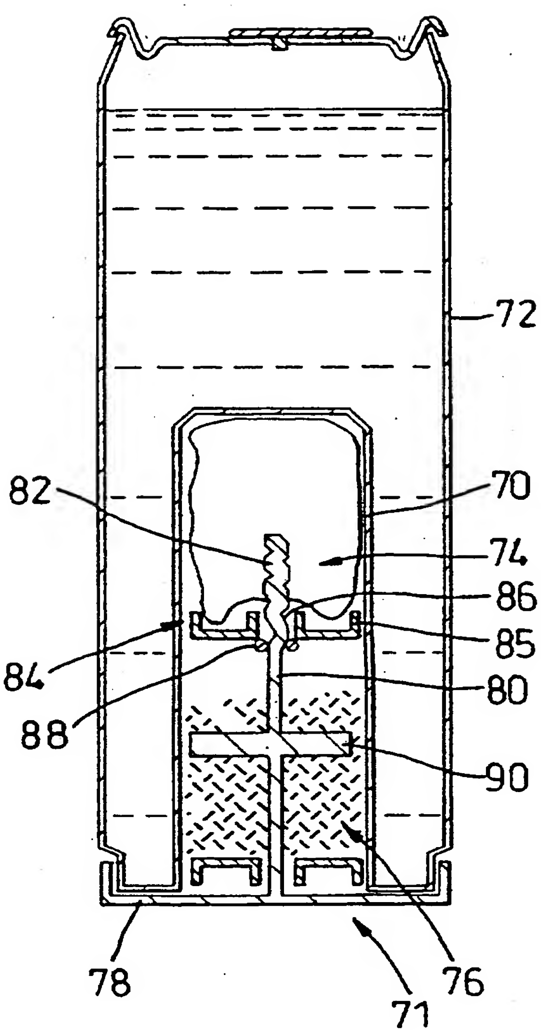
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Fig. 5

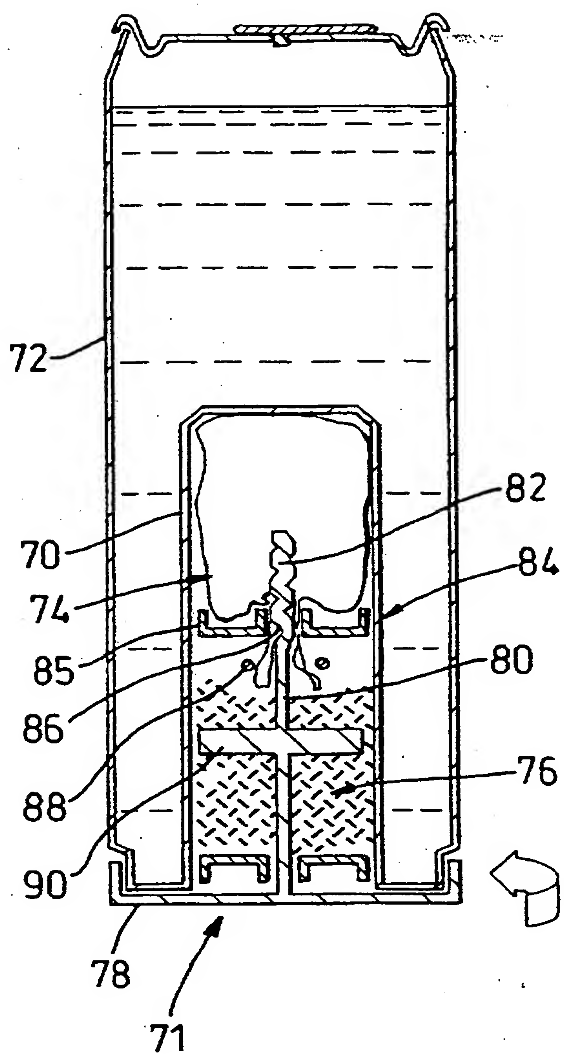
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Fig. 6

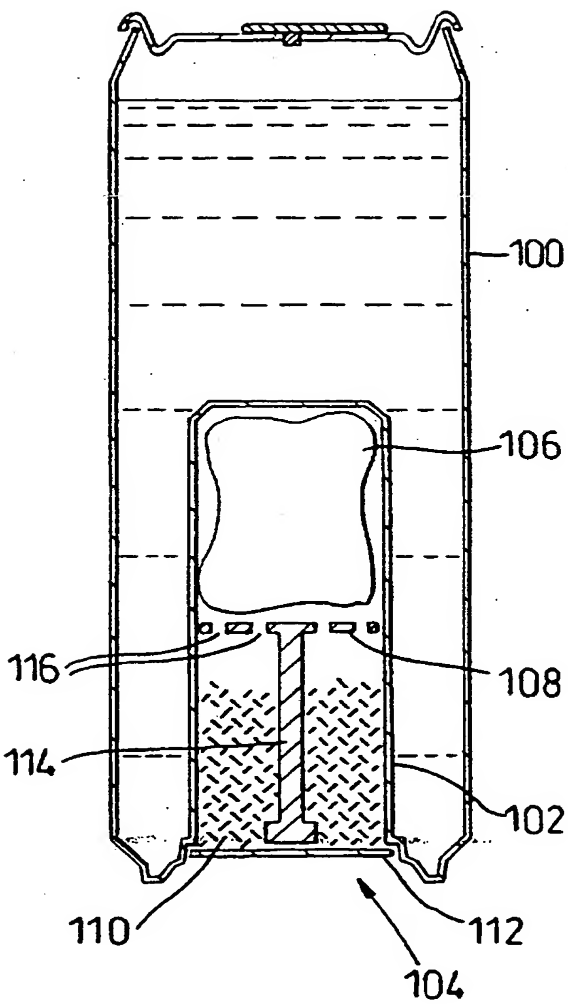
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Fig. 7

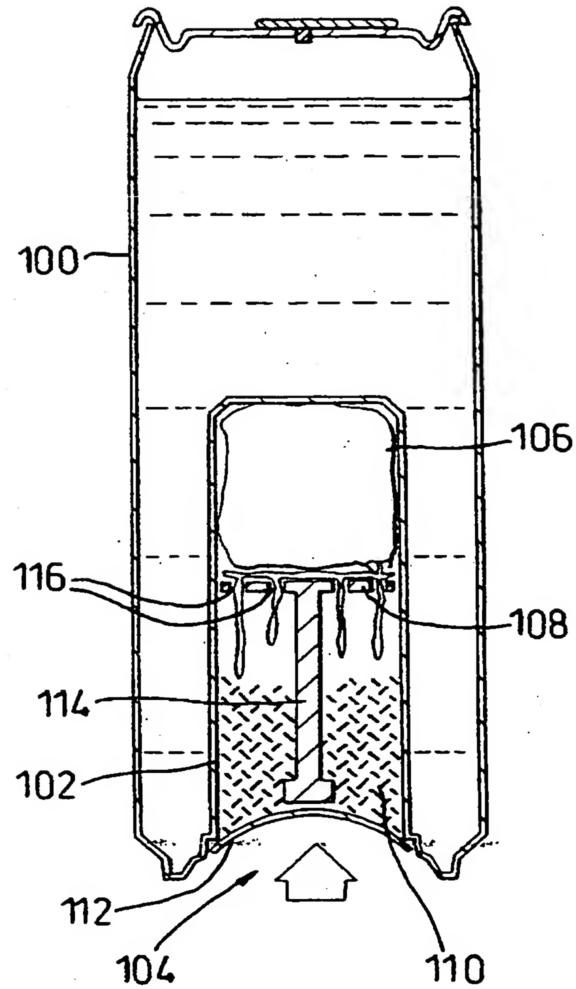
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Fig. 8

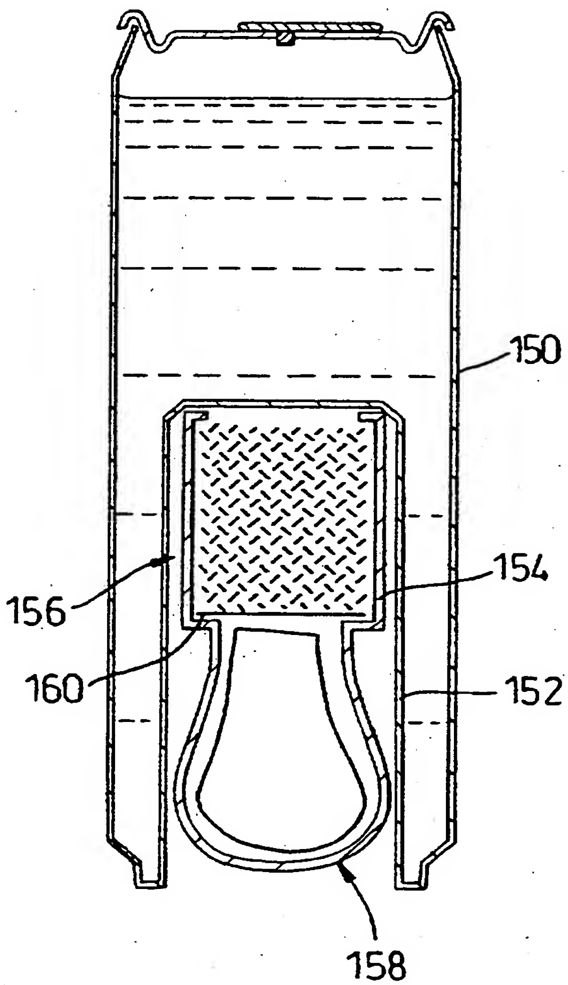

Fig. 9

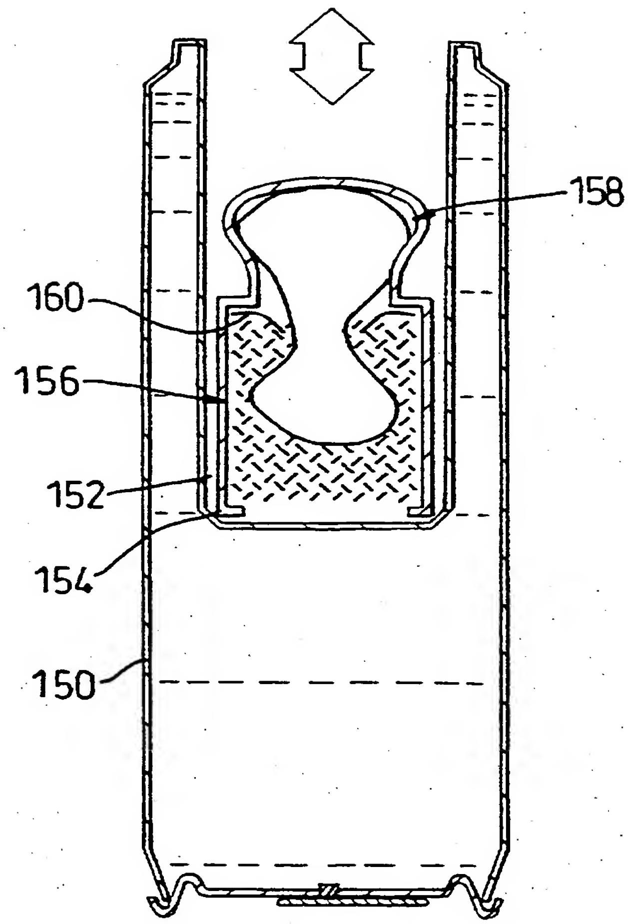

Fig. 10

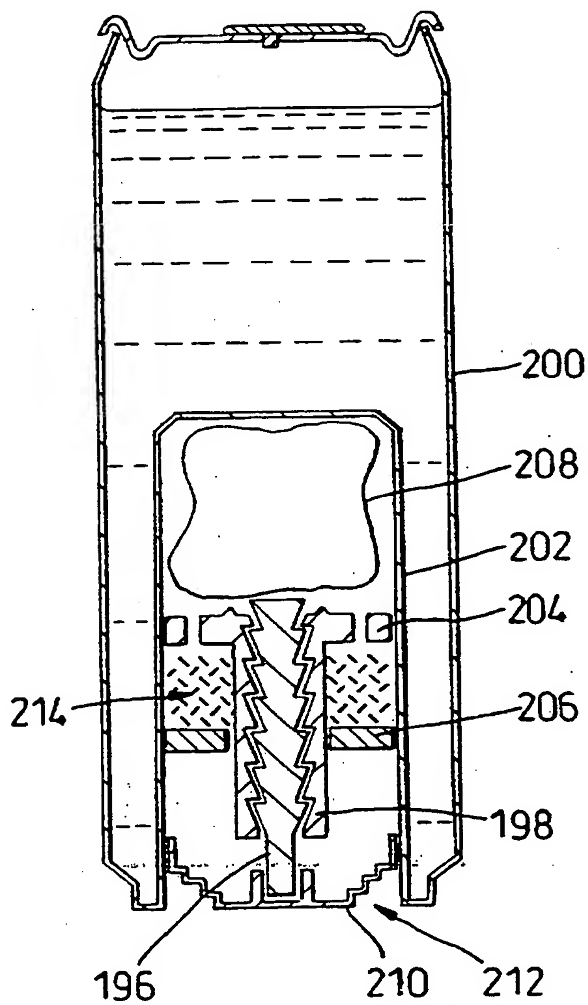
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Fig. 11

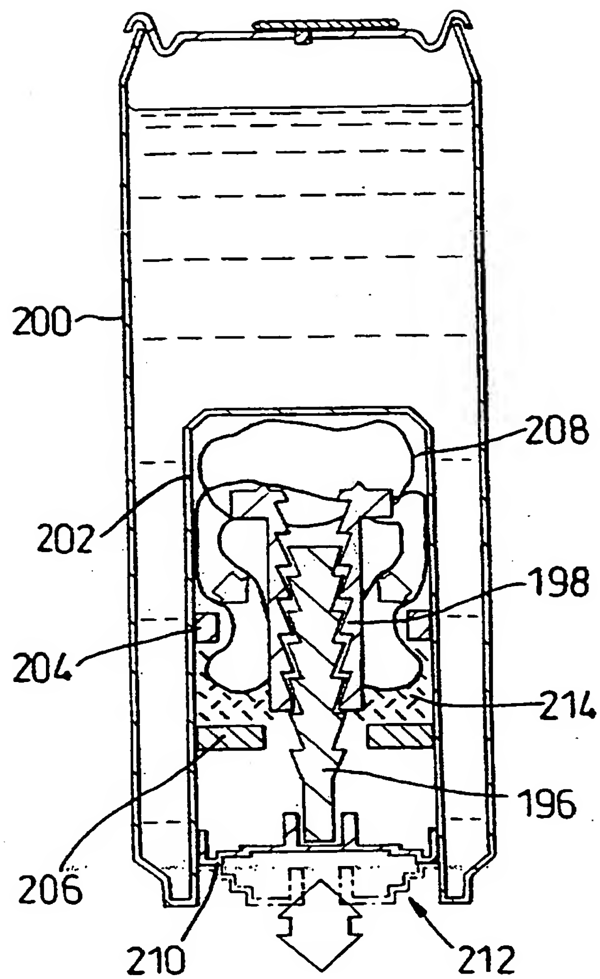
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Fig. 12

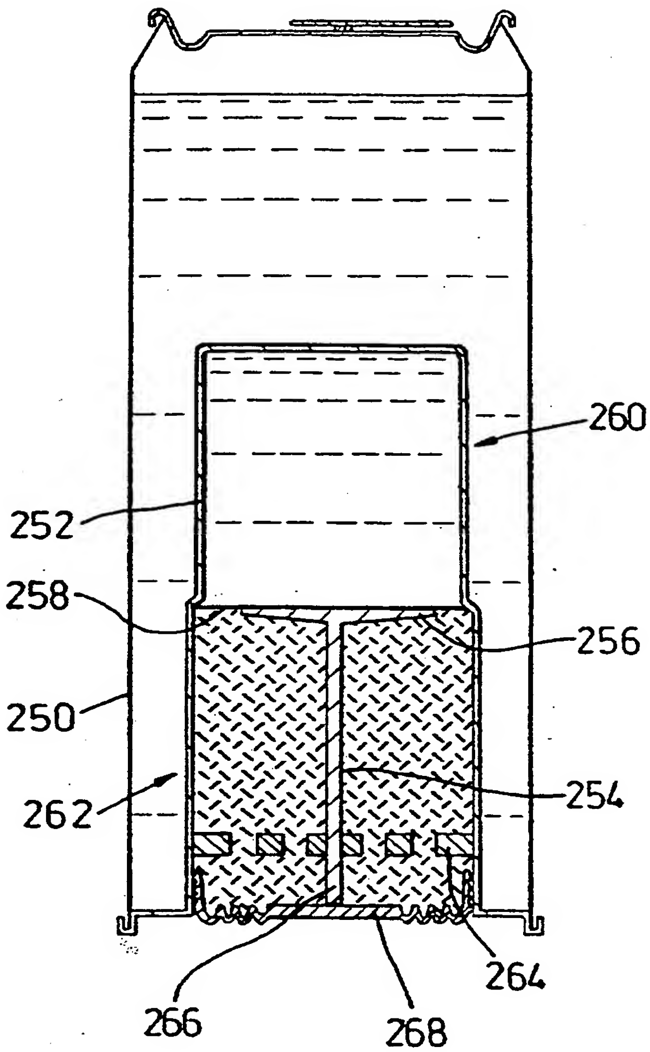
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Fig. 13

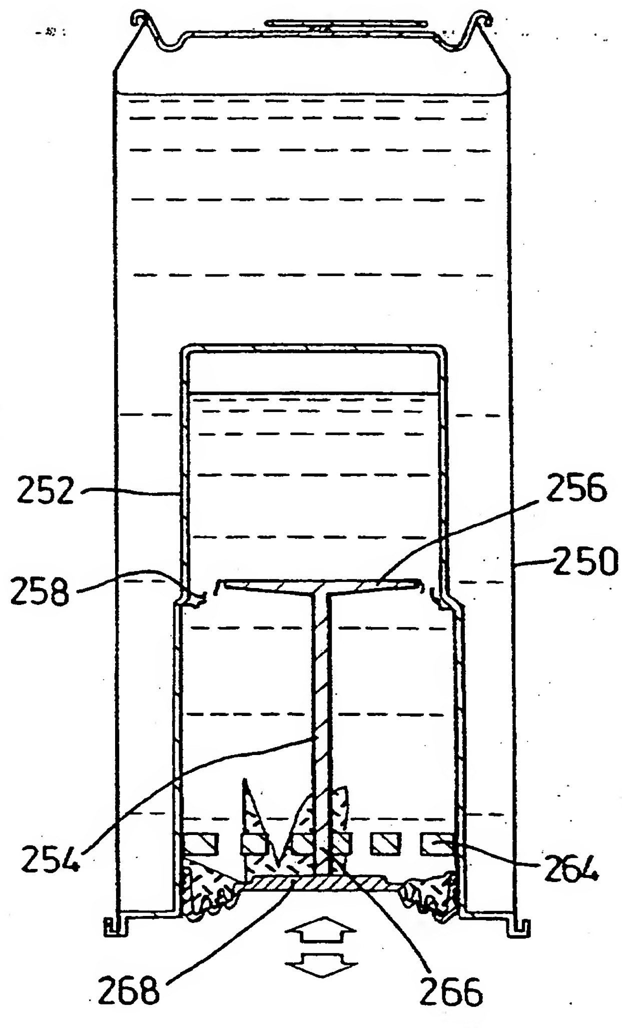
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Fig. 14

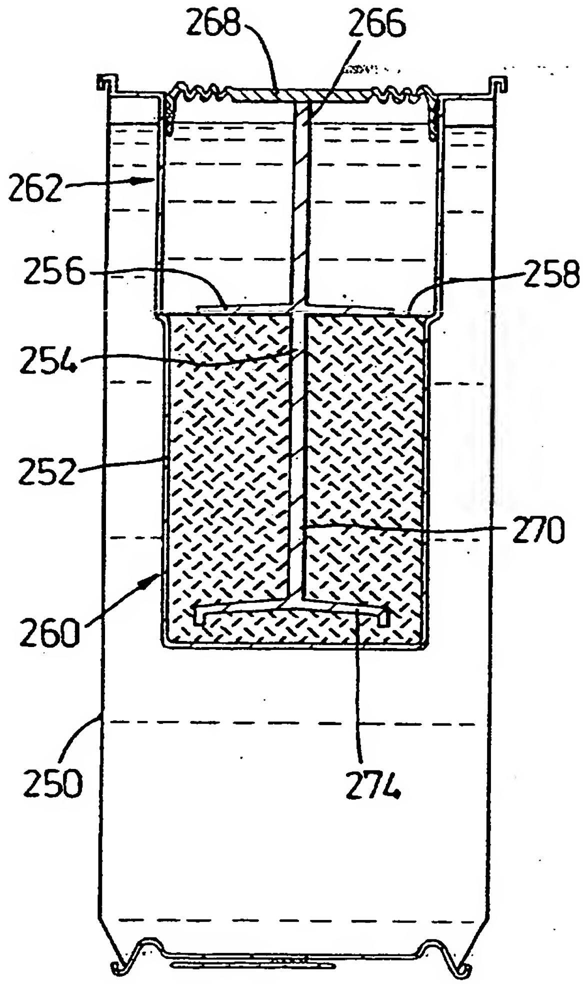
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Fig. 15

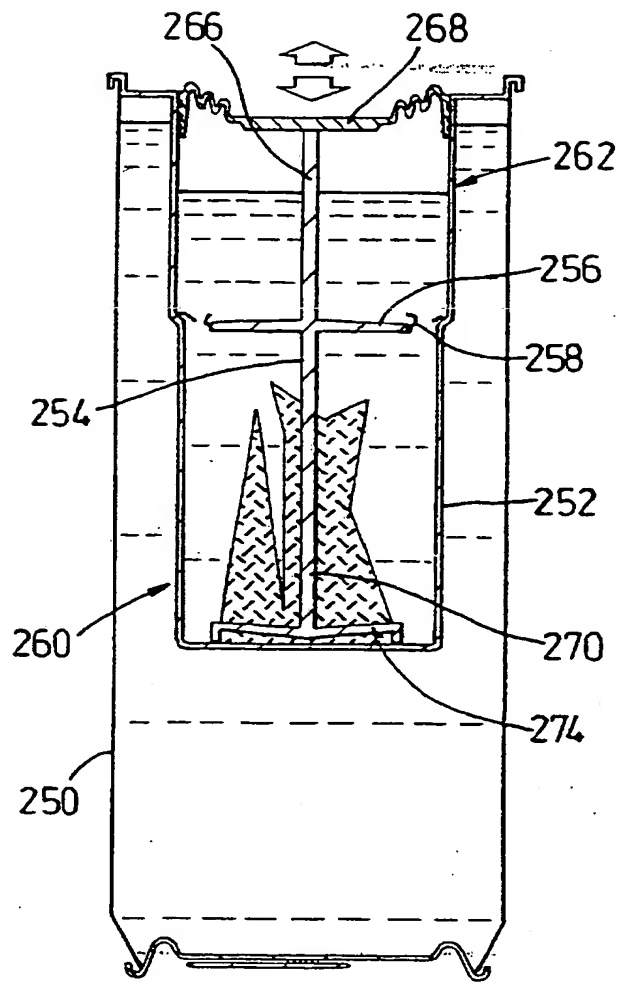
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Fig. 16

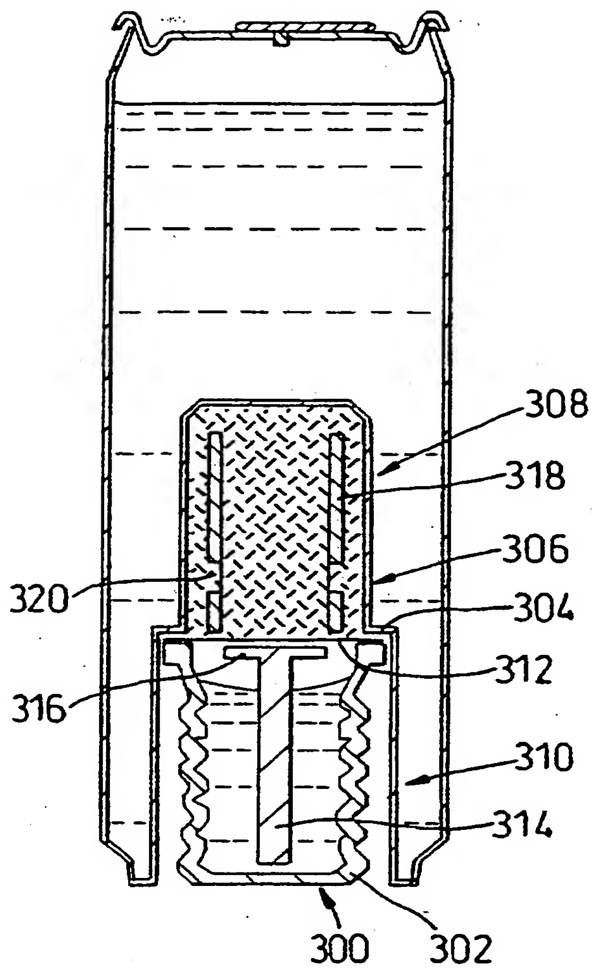
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Fig. 17

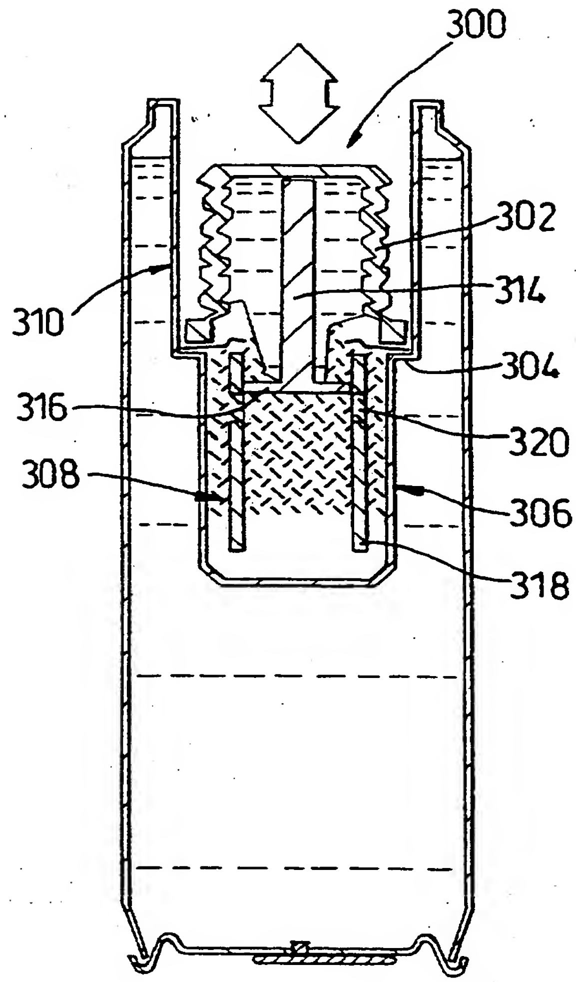
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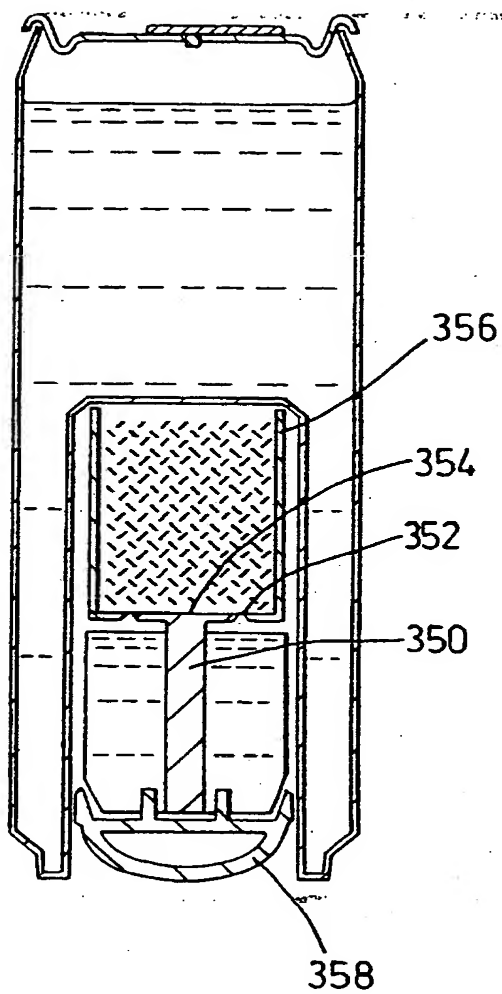
Fig. 18



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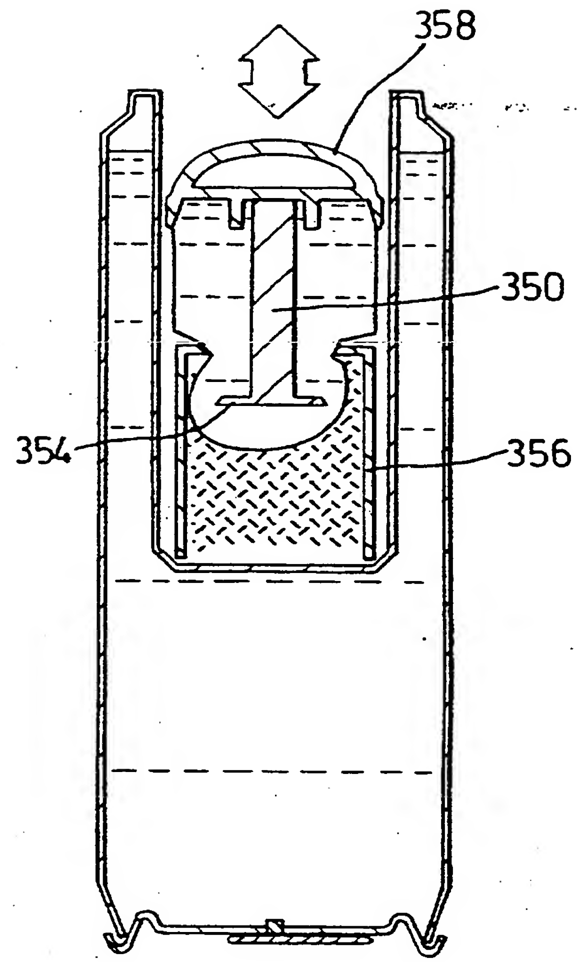
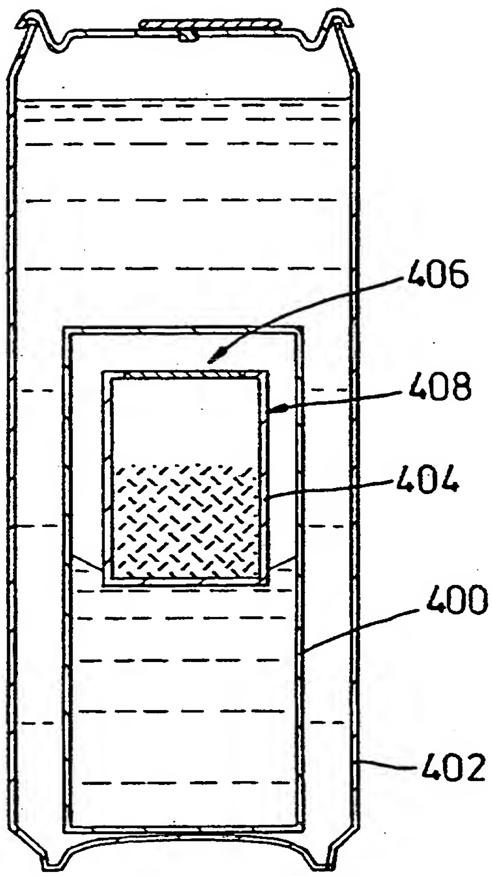


Fig. 20



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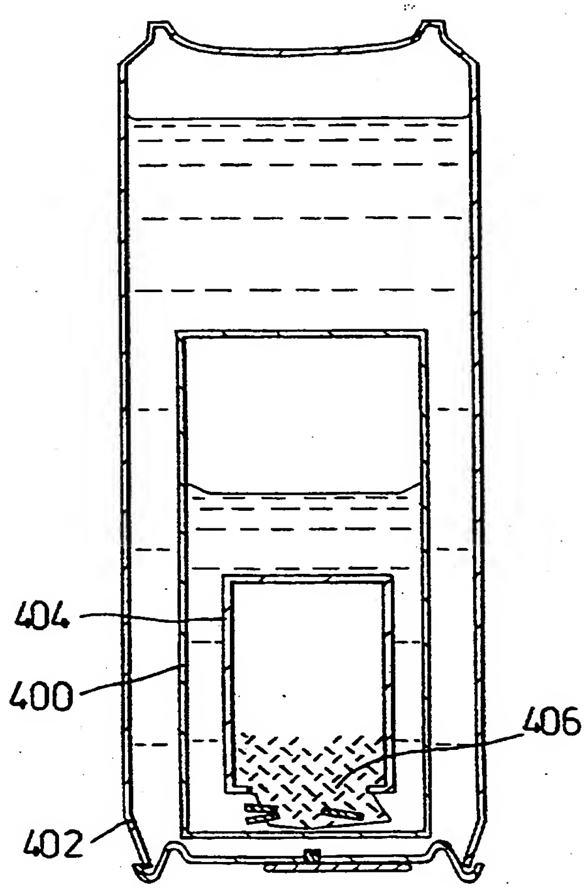

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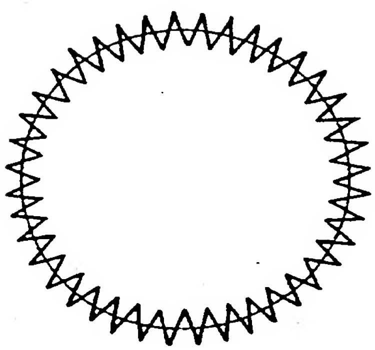

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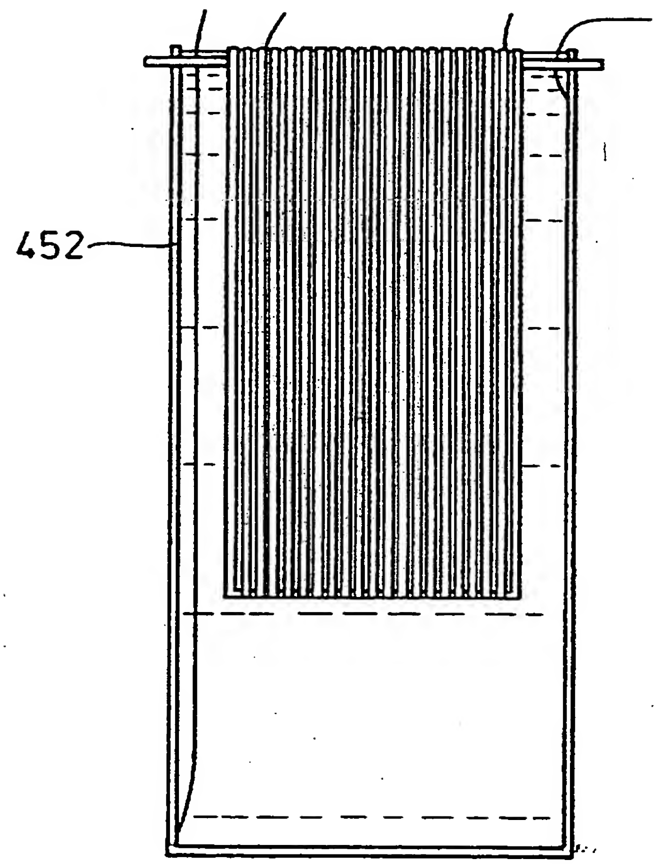

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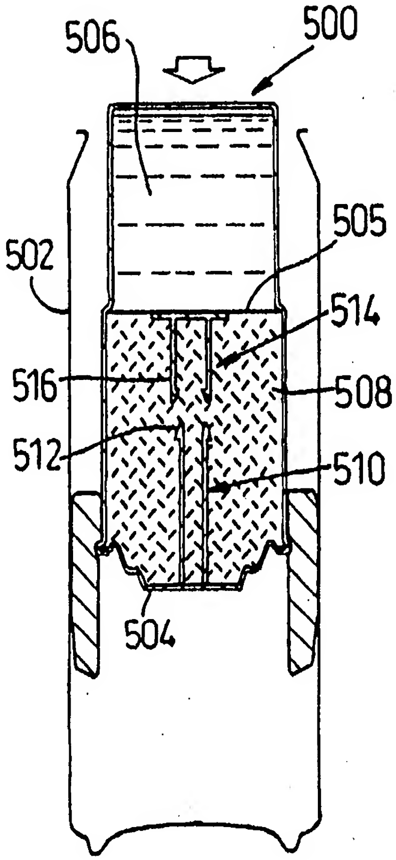

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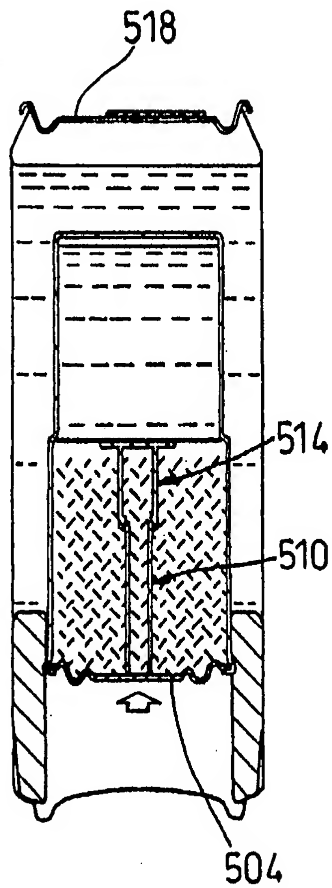


Fig. 26

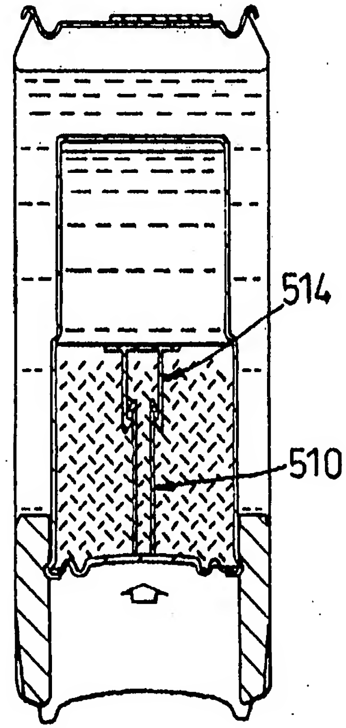
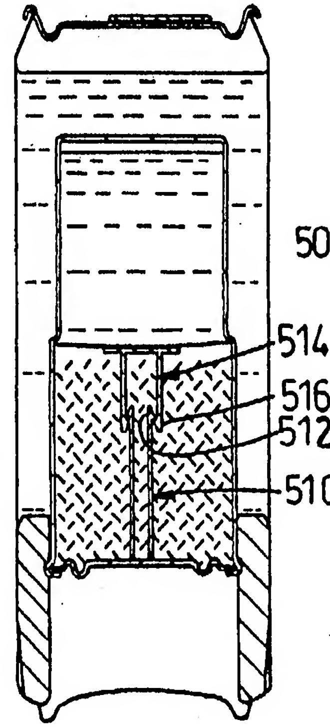


Fig. 27



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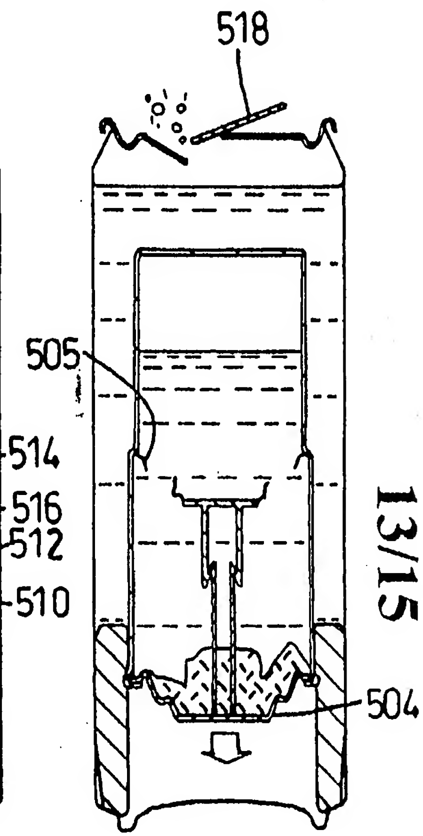

Fig. 29

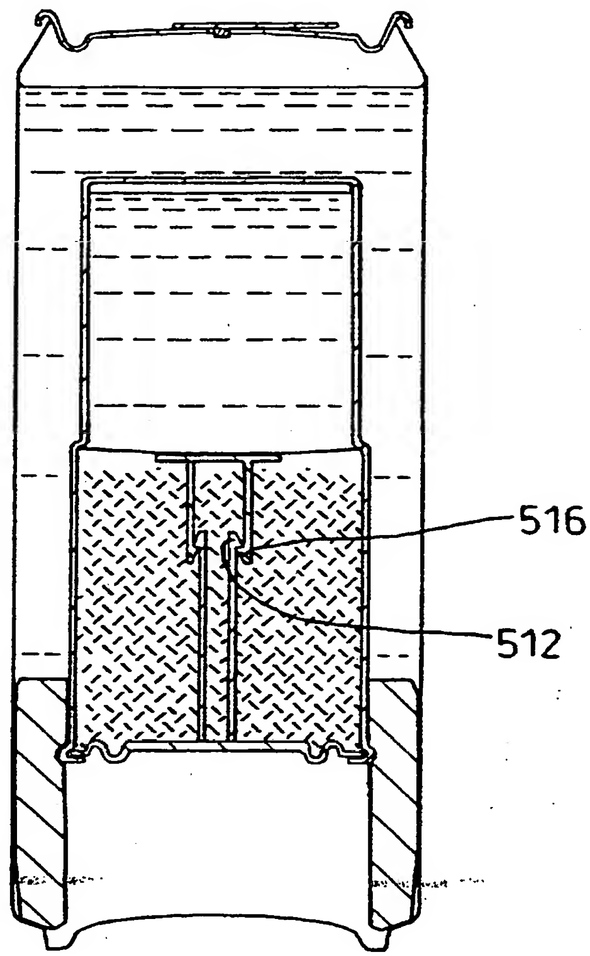

Fig. 30

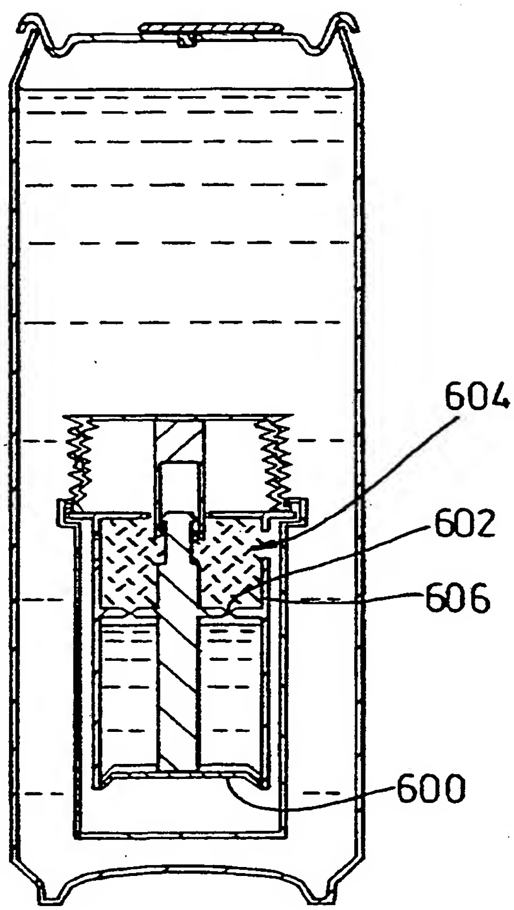

Fig. 31

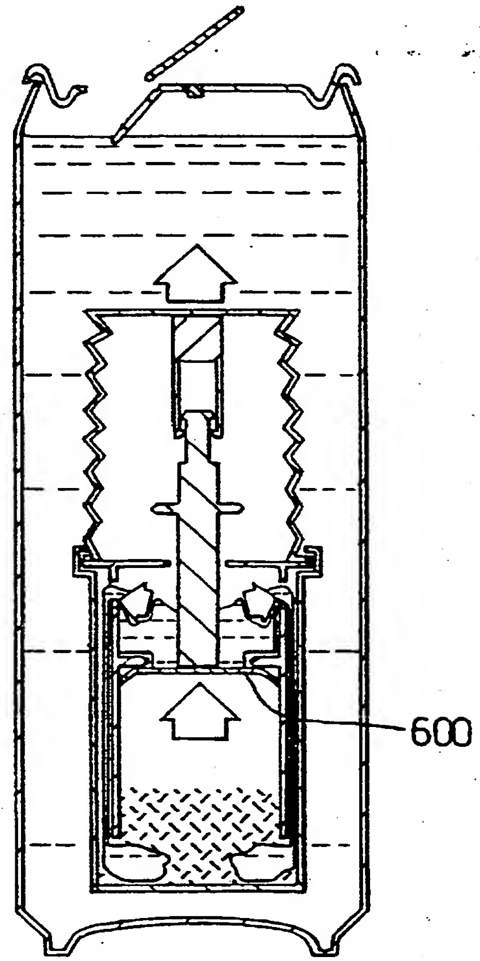

Fig. 32

IMPROVEMENTS RELATING TO CONTAINERS

This invention relates to providing a self cooling container adapted to contain a beverage or other foodstuff and a method of cooling containers for beverages or other foodstuffs.

It is well known to provide beverages in drink containers such as cans. This has been performed for many years. Canning technology is well developed. It is also well known that consumers like to consume certain beverages only after that beverage has been chilled. This usually requires that the can be externally chilled and therefore requires cooling apparatus, such as a fridge, ice, etc. to allow the beverage to be cooled.

Clearly this can be a disadvantage if the consumer happens to be in a situation wherein none of these facilities are available. Perhaps, the consumer may be in a remote situation, etc.

It would therefore be an advantage to provide a self cooling beverage container, such as a can, which can provide a consumer with a chilled beverage. Such a beverage container has been desired for some time but previously has not been realisable. Previous attempts have relied on the use of ozone destroying refrigerants which is clearly undesirable.

According to a first aspect of the invention there is provided a beverage, or other foodstuff, container which is provided with a cooling means adapted, in use, to chill a beverage, or foodstuff, contained within the container.

The beverage container may be a can.

Preferably the container looks like a standard container for that particular product. That is the container may look like a container which is usually used to hold that product but without the ability to chill the contents. This provides market continuity for the users of the product.

The container may use an endothermic dissolving or dissolution of a first chemical into a second chemical to achieve cooling. Advantages of this include the ability to avoid the need to use an ozone destroying refrigerant.

The first chemical may be ammonium nitrate. The second chemical may be water. These chemicals are advantageous because they are relatively cheap, of low toxicity, and relatively easy to obtain.

A cooling chamber may be provided which contains the cooling means so as to maintain the cooling means separate from the beverage contained within the container. An advantage of this is that contamination, or tainting, of the beverage is avoided.

The cooling chamber may be provided within the container. Alternatively, or additionally, the cooling chamber may be provided in association with the outside of the container (perhaps as a jacket, or similar).

Should the cooling chamber be provided within the can or other container it may be provided as a cylindrical chamber. This has the advantage that it is easy to fabricate, and is a robust shape so that it can be readily adapted to withstand the pressures exerted upon it within a canning production process.

The cooling chamber may be provided as blind bore integrally formed in to lower end portion of a container or can. An advantage of this is that the resulting structure is cheap to manufacture and robust.

An external activation means may be provided on the can to activate the cooling means. This has the advantage that the activation means is readily accessible by a user.

Alternatively, an internal activation means may be provided which may operate when the beverage, or foodstuff, container is opened so providing a container which automatically cools the beverage within when it is opened.

An internal activation means may be operated by a drop in pressure as the container is opened. Such a drop in pressure is well known when cans containing carbonated beverages are opened

The activation means may cause a membrane, divider, partition, bag, or other such device (hereinafter referred to as a membrane) which separates the two chemicals (perhaps each contained in a separate portion of the cooling chamber) to rupture thus allowing the two chemicals to mix and the endothermic dissolution process to begin.

The membrane may comprise a burstable bag, or other similar volume containing structure, which separates the first and second chemicals (or may prevent a chemical being released).

The membrane may be ruptured by a sharp barb, blade, or other similar structure, being caused to penetrate the membrane by the activation means. Alternatively, or additionally, the membrane may have

a frangible joint which is caused to break by the activation means. In yet a further embodiment the membrane may be ruptured by a screw or other such helical device. A component of the cooling chamber (or in the cooling chamber) may be pulled or pushed against a disruption element to break the seal allowing two chemicals to mix, or releasing a chemical. In yet another embodiment a soluble membrane is provided which dissolves allowing the two chemicals to mix.

Another possible activation means may be the provision of a bellows type arrangement which when compressed, in use, causes the membrane to rupture. A plunger may be provided which when, in use, is pressed causes the membrane to rupture. All of these alternatives provide suitable mechanisms for allowing the two chemicals to mix.

The membrane means may comprise at least two plates, perhaps axially aligned and perhaps next to one another, each of which contains at least one hole or passage. In the unactivated state these holes or passages may be unaligned, and the activation means may align the holes or passages. This alignment may allow the two chemicals to mix (perhaps by interconnecting two portions of a chamber, or two separate chambers).

An agitation means may be provided to ensure the first and second chemicals are mixed properly so ensuring that the endothermic dissolution process proceeds at a satisfactory rate. The agitation means may be manually powered or powered by a power source (e.g. a battery, such as a watch battery).

The activation means may comprise a handle providing a convenient means for a user to grasp. The handle may be connected to

the agitation means so that as the user moves the handle the agitation means is operated.

The agitation means may be provided in association with the membrane means. Alternatively, or additionally, the agitation means may be remote from the membrane means.

The agitation means may comprise vanes, which may be in contact with the first and second chemicals and may possibly be adapted to move about an axis of rotation. When the vanes are rotated, or moved angularly, (possibly in a cyclic motion) the first and second chemicals are agitated.

Alternatively, or additionally, the agitation means may comprise a member, e.g. a perforated plate, which as it is moved through the first and second chemicals causes agitation and speeds the reaction. The member may be moved in a straight line. It may be reciprocated.

Alternatively, or additionally, the agitation means may comprise a piston or other such like structure which is adapted, in use, to be moved, possibly, cyclically in an axial direction within the first and second chemicals once they have been mixed.

The agitation means may be thought of as a turbulence inducing means. Alternatively, or additionally, a separate turbulence inducing means may be provided. Such a separate turbulence inducing means may comprise a holes, ducts, openings, etc. in a member. The member may be a wall member, or may be in the agitation means. Such a wall member may be in a fixed relationship to the can or the cooling chamber.

The agitation means alternatively, or additionally, may comprise a means powered from an external source; perhaps an electric motor connected to a vaned member or other such impeller or stirring means, or is perhaps an electric pump. The power source may be a battery, perhaps a watch type battery. Alternatively, or additionally, the power source may comprise a solar cell.

A micro processor or other suitable integrated circuit (for instance a programmable logic array, etc.) may be used to control an electrically powered agitation means. An advantage of this is that the mixing process could be controlled accurately.

Switch means may be provided on the outside of the container to activate an electrically powered agitation means. The switch means may comprise an activation means.

Magnetic coupling means may be provided to link the agitation means provided inside the container to an operative means outside the container. This may be convenient in some situations allowing the agitation means to be activated without compromising the integrity of the container. This may removing the need for seals, etc.

In yet another embodiment the agitation means may comprise a bellows means which are adapted, in use, to be activated, so as cause turbulence within the first and second chemicals. Activation of the bellows may comprise compression of the bellows followed by subsequent release.

The bellows means may comprise a bulb of resilient material or may comprise a container of resilient material with corrugated walls.

Both of these provide suitable means to impart turbulence into the mixed first and second chemicals.

In yet a further embodiment a rack and pawl mechanism may be provided which can be repeatedly activated and thus impart a movement of one of the parts of the mechanism relative to the other of the parts. Such a mechanism can prove useful in progressively acting upon a membrane; the relative movement of one of the parts can be utilised.

Perhaps the membrane may comprise a bag containing one of the two chemicals and the rack and pawl mechanism can be used to burst the bag and subsequently act upon the bag, as the mechanism is repeatedly activated, thus ensuring that the contents of the bag are emptied.

An activation means may be provided to act upon the rack and pawl mechanism.

A heat transfer means may be provided to ensure that more efficient heat transfer occurs between the cooling means and the beverage, or foodstuff, contained in the container.

The heat transfer means may comprise a cylinder with corrugated or grooved walls so as to provide a large area over which heat transfer can occur.

Preferably the heat transfer means is fabricated from a metal. A metal heat transfer means is advantageous because they can be cheap and yet have are good conductors of heat.

The heat transfer means may be the cooling chamber.

Alternatively, or additionally, the container may use a Peltier effect cooling system. When a battery, or other electrical power source, is provided it may power a Peltier effect cooler and mixing or stirring means.

Yet another alternative, or addition, would be the use of evaporation of water (or another liquid) to provide the cooling effect. Preferably the evaporation of the water would be vacuum driven. The use of water is advantageous because water is non toxic, readily available and inexpensive.

A desiccant material may be used to facilitate this. Advantages of such a system are that the pressures involved are low, and also desiccant materials are relatively inexpensive.

The desiccant may be calcium sulphate, or may be silica gel, or may be low density silica gel, or may be a zeolite. Each of these chemicals would exhibit the desired properties.

Insulation may be provided adjacent a desiccant or adsorbent material. Insulation can prevent heat released in a hydration process from reaching the contents of the container. Clearly, this is advantageous because this prevents the contents from being heated rather that cooled.

In still yet another embodiment the heat absorbed to evaporate a volatile liquid may be utilised, or indeed the boiling of (or expansion of) a compressed gas may be utilised.

The gas may be butane, propane, carbon dioxide, a hydrofluorocarbon (HFC) (perhaps HFC134a or perhaps HFC152a), nitrogen, dimethyl ether, or other suitable refrigerant gas.

Advantages of Butane and Propane are that they are low cost and already widely used in aerosols.

Carbon dioxide is advantageous in that it is non-toxic, is readily available.

Hydrocarbons are advantageous because they are good refrigerants, require a large amount of heat to evaporate, and are non-flammable.

A vortex tube means may be used to restrict the rate at which the gas boils by restricting the rate at which the gas escapes to the atmosphere.

A pressuriseable container capable of maintaining the gas or the liquid under pressure may be provided to hold the gas or liquid.

The container may be adapted to be recycled once the container has been used. The container may therefore contain only (or substantially only) materials which are readily recyclable and in the preferred embodiment the container may be manufactured from substantially only one material. It is obviously recognised that a small amount of other material (for instance sealing members, paints, lacquers, etc.) will need to be used in association with the container.

The pressuriseable container may be provided as a recyclable unit which is inserted into a can to allow the can to perform its self cooling

function. The pressuriseable container may be insertable into and removable from the container.

Preferably the container is adapted, in use, to reduce the temperature of its contents by substantially between 5°C and 19°C. Possibly by about between 9°C and 15°C. In one embodiment the container reduces the temperature of its contents by at least 12°C. These ranges provide a suitable temperature drop so that the beverage, or foodstuff can be cooled from ambient temperature to a temperature at which they are pleasant to consume.

The contents of the container may be cooled to substantially between 4°C and 10°C. Preferably the contents of the container are cooled to substantially between 6°C and 8°C. Again the contents of the container may be pleasant to consume once they have been cooled to within this temperature range.

Ideally the cooling of the contents may take place in substantially 30 seconds, or 45 seconds, or 60 seconds, or 75 seconds, or 90 seconds, or 120 seconds or 180 seconds, or any intermediate time between these time periods. These time periods are believed to be the length of time a user of the container may find convenient to wait for the contents of the container to be cooled.

Preferably the volume of beverage or foodstuff which can be held within the container is substantially 330ml. Of course other volumes may be allowable: perhaps 250ml, 500ml.

The container may meet food and hygiene legislatory requirements.

The skilled person will appreciate that the agitation means may also function as the activation means and vice versa.

According to a second aspect of the invention there is provided a method of cooling a beverage or foodstuff container.

The method may include using an endothermic dissolution process, or may be relies on the Peltier effect, or may be the evaporation of water or other liquid, or may be the evaporation of a volatile liquid, or may be the boiling of a compressed gas.

The method may include mixing a first and a second chemical to cool the contents of the container. The first chemical may be water. The second chemical may be ammonium nitrate.

Should a gas be used it may be butane, or propane, or carbon dioxide, or nitrogen, or dimethyl ether, or an HFC (perhaps HFC134a or perhaps HFC152a).

The method may utilise any of the features described in relation to the first aspect of the invention.

According to a third aspect of the invention there is provided an insert for a beverage, or foodstuff, container which, in use, cools the contents of the container.

According to a fourth aspect of the invention there is provided beverage, or foodstuff container, which has been filled with a beverage or foodstuff and also filled with an insert according to the third aspect of the invention.

There now follows by way of example only a detailed description of the present invention with reference to accompanying drawings of which:

Figure 1 shows a schematic diagram of a beverage of foodstuff container with a self cooling jacket according to the present invention;

Figure 2 shows a schematic diagram of the beverage container of Figure 1 showing the jacket in section;

Figure 3 shows a schematic diagram of a beverage of foodstuff container according to the present invention with a chamber containing the cooling means and a plunger activation means;

Figure 4 shows a schematic diagram of a beverage of foodstuff container according to the present invention with a chamber containing the cooling means and a rotatable knife activation means;

Figure 5 shows a schematic diagram of a beverage of foodstuff container with a cooling means according to the present invention which has a rotatable activation means together with vanes or agitation means;

Figure 6 shows the container of Figure 5 once the cooling means has been activated;

Figure 7 shows a schematic diagram of a beverage of foodstuff container with a cooling means according to the present invention with a plunger agitation means and a push button activation means;

Figure 8 shows the container of Figure 7 with the cooling means in the activated condition;

Figure 9 shows a schematic diagram of a beverage of foodstuff container with a cooling means according to the present invention with a bellows activation and agitation means;

Figure 10 shows the container of Figure 9 with the cooling means in the activated condition;

Figure 11 shows a schematic diagram of a beverage of foodstuff container with a cooling means according to the present invention with a rack and pawl agitation means;

Figure 12 shows the container of Figure 11 with the cooling means in the activated condition;

Figure 13 shows a schematic diagram of a beverage of foodstuff container with a cooling means according to the present invention with a push button activation means and a plunger agitation means associated with a membrane means;

Figure 14 shows the container of Figure 13 with the cooling means in the activated condition;

Figure 15 shows a schematic diagram of a beverage of foodstuff container with a cooling means according to the present invention similar to that shown in Figures 13 and 14 but with an extra agitation means;

Figure 16 shows the container of Figure 15 with the cooling means in the activated condition;

Figure 17 shows a schematic diagram of a beverage of foodstuff container with a cooling means according to the present invention with a bellows activation and agitation means together with a plunger agitation means;

Figure 18 shows the container of Figure 17 with the cooling means in the activated condition;

Figure 19 shows a schematic diagram of a beverage of foodstuff container with a cooling means according to the present invention with a plunger activation and agitation means;

Figure 20 shows the container of Figure 19 with the cooling means in the activated condition;

Figure 21 shows a schematic diagram of a beverage of foodstuff container with a cooling means according to the present invention with a soluble membrane;

Figure 22 shows the container of Figure 20 with the cooling means in the activated condition;

Figure 23 shows a plan view of a heat transfer means;

Figure 24 shows a schematic diagram of a beverage of foodstuff container with a cooling means according to the present invention in which there is provided the heat transfer means of Figure 23;

Figures 25 to 29 show the various stages of assembly of a beverage of foodstuff container which has within it an internal activation means;

Figure 30 shows a view of the container shown in Figures 25 to 29 in greater detail;

Figure 31 shows another embodiment of a container with a cooling means according to the present invention in which there is an internal activation means; and

Figure 32 shows the container of Figure 31 in the activated condition.

The present invention although applicable to the field of beverages and foodstuffs in general will be described here with reference to the field of canned carbonated beverages. Such as beer, lager, ale, stout, porter, and the like.

The beverage can is well known. Figures 1 and 2 show a standard 330ml beverage can 2 around which a cooling means comprising a jacket 4 has been provided.

The jacket 4 comprises and inner wall 6 and an outer wall 8 between which a fluid or powder containing space 10 is provided. In Figure 1 a vertical breakable or deformable barrier 1 is provided which separates a quantity of water 3 from a quantity of ammonium nitrate 5.

In Figure 2 at approximately a mid point of the can there is provided an annular bag 12 which is inflated with air (or contains air) and which divides the fluid and powder containing space 10 into an upper portion 14 and a lower portion 16.

The lower portion 16 of the fluid or powder containing space contains ammonium nitrate powder and the upper portion 14 contains water. The ammonium nitrate and the water are prevented from mixing the inflated bag 12 between the two portions 14, 16.

In both of the embodiments there is provided a layer of insulation 18 outside the outer wall 8 which helps to thermally isolate the can from its surroundings.

In use, a user would press the inflated bag 12 causing it to rupture or similarly break the barrier 1 and consequently allow the contents of the upper 14 and lower 16 portions of the fluid or powder containing space 10 (or the water 3 and ammonium nitrate 5 of Figure 1) to mix. An endothermic reaction occurs as the water and ammonium nitrate contact each other. The insulating layer 18 prevents heat being absorbed from the outside of the can and therefore the heat required by the endothermic reaction is absorbed from the contents of the can. The beverage is therefore chilled.

The advantages of a cooling sleeve are that it can be used with a standard drinks can.

The can 30 shown in Figure 3 has a cylindrical chamber 32 depending from the inside of an upper surface 34. It will be noted that the standard ring pull arrangement 36 has been moved to accommodate this.

There is an upper portion 38 and a lower portion 40 of the chamber 32 each of which contains one of two chemicals necessary to perform an endothermic dissolution reaction. In this embodiment the upper portion 38 contains water and the lower portion 40 contains ammonium nitrate.

On the outside top surface portion 42 of the can a ring 44 is provided which is connected via a rod 46 to a frangible membrane 48. A line of weakness is provided around a perimeter portion of the membrane 48. The skilled person will realise that the perimeter portion may include a line of weakness around a circumference of the membrane 48.

In use, to chill the beverage contained in the can a user pulls the ring 44. This force is transmitted along the rod 46 to the membrane 48. Once the force exceeds the failure strength of the line of weakness the membrane fails allowing the two chemicals to mix. This allows the endothermic reaction proceed.

Because the chamber 32 is contained within the can 30 the heat necessary to maintain the dissolution process is taken from the beverage contained in the can 30 and the beverage is consequently cooled.

Figure 4 shows an embodiment wherein a can 50 has a cylindrical chamber 52 supported from a bottom end face portion 54. Unlike the embodiment shown in Figure 3 this allows a standard ring pull to be used. Of course, the skilled person will realise that in the embodiment shown in Figure 3 the central cylinder 32 could also be made to be supported by a bottom end face portion of the can 30.

The cylindrical chamber 52 like that shown in Figure 3 is divided into two portions by a membrane 56 at a central portion 58. However, unlike the membrane 48 of Figure 3, there is no frangible portion but the membrane 56 is fabricated from a material which is readily cut by a knife 60 which is connected to an twistable activation means 62 external of the can 50 comprising a disc on the outside of the bottom end face portion 54.

A top portion 64 of the cylindrical chamber 52 contains one of the two chemicals required to perform an endothermic dissolution reaction and a bottom portion 66 contains the other of the two chemicals.

In use, when a user wishes to chill the beverage within the can 50 then they twist the activation means 62 thus rupturing the membrane 56 with the knife 60. This rupturing allows the two chemicals held within the top and bottom portion 64, 66 to mix and thus the endothermic dissolution process can begin. The heat input required to allow the process to proceed is taken from the beverage surrounding the cylindrical chamber 52 thus cooling the beverage.

In Figures 5 and 6 there is also a cylindrical chamber 70 supported by a bottom end face portion 71 of a can 72. However, unlike the

embodiments shown if Figures 3 and 4 there is no membrane dividing the cylindrical chamber 70 into two portions. In this embodiment a membrane is provided by a bag means 74 which contains a quantity of water. A quantity of ammonium nitrate 76 is provided surrounding the bag means within the cylindrical chamber. The bag means 74 ensures that the two chemicals do not mix.

A disc like member 78 is attached to an outer face of the bottom end face portion 71 of the can 70. Depending from the inner face of the disc member 78 is a rod 80 which has a screw portion 82 at the opposite end portion from the disc member which contacts the bag means 74. At a mid portion 84 of the cylindrical chamber 70 there is provided a support means 85 comprising a disc within the cylindrical chamber 70 which has an opening 86 at a central portion through which the rod 80 passes. On a lower face of the support means 85 there is provided a seal 88 comprising an annular ring of resilient material sealing the opening through the support member 85.

It will be noticed that the ammonium nitrate 76 is below the support member 85 and that the water within the bag means 74 is above. Therefore should the bag means 74 be ruptured inadvertently the two chemicals would not mix freely. It will be realised that the support member 85 is sealed to the inner surfaces of the outer walls of the cylindrical chamber 70.

Vanes 90 depend from the rod 80 at substantially a right angle from the rod 80.

In use, a user twists the disc member 78 which acts as an activation means. This twisting motion rotates the screw portion 82 of the rod 80 so

that it acts upon the bag means 74. The action of the screw portion 82 draws the bag means 74 toward the support means 85 and this action eventually ruptures the bag means 74 causing release of the water. Also as the bag means 74 is drawn through the support means 85 the seal 88 ruptures thus freely connecting either side. The water and ammonium nitrate mix starting the endothermic dissolution process and thus cooling the beverage contained within the can 72.

The user can continue to rotate the disc member 78 which causes the vanes 90 to agitate the water and ammonium nitrate mixture ensuring that they mix well thus increasing the rate of the dissolution process. This increased rate in turn increases the speed at which the beverage within the can is cooled.

A can 100 with a cylindrical chamber 102 depending from an inner face of a lower end portion 104 is shown in Figures 7 and 8. As with the embodiment shown in Figures 5 and 6 a quantity of water is contained within a membrane comprising a bag means 106 which is positioned in an upper portion of the cylindrical chamber 102 above a plunger 108. Below the plunger is a quantity of ammonium nitrate 110.

The bottom end face of the cylindrical chamber 102 is sealed by an activation means comprising a diaphragm 112. The plunger 108 is connected to the diaphragm 112 by a rod 114. Within the plunger 108 there are a number of openings 116 which allows matter (for instance the water and ammonium nitrate) to pass across the plunger 108.

To activate the cooling mechanism a user presses the diaphragm (activation means) 112 which causes the plunger 108 to move axially along the cylindrical chamber 102 compressing the bag means 106. The

pressure exerted by the plunger 108 causes the bag means 106 to burst thus releasing the water contained therein. The water is free to pass across the plunger 108 by passing through the openings 116 (the openings can be thought of turbulence inducing means in the agitation means) and to mix with the ammonium nitrate 110. This of course starts the endothermic dissolution process which cools the contents of the can 100.

To increase the rate at which the dissolution process proceeds the user can repeatedly press the diaphragm 112. This has the effect of causing the plunger 108 to repeatedly move and thus act as an agitation means stirring the contents of the cylindrical chamber 102.

In the embodiment shown in Figures 9 and 10 there is again a can 150 and a cylindrical chamber 152 depending from a lower portion of the can 150. However, in this embodiment within the chamber 152 there is provided a wall member 154 formed from a resilient material. The wall member 154 comprises a cylindrical portion 156 and a bulb like portion 158. The upper end most portion of the cylindrical portion 156 of the wall member 154 is sealing connected to the inner surface an end face of the cylindrical chamber 152.

Although the cylindrical portion 156 and the bulb portion 158 are moulded as one initially they are separated by a membrane 160. The bulb portion 158 contains a quantity of water and the cylindrical portion 156 contains a quantity of ammonium nitrate. The membrane 160 prevents the water and the ammonium nitrate from mixing.

To operate the cooling means a user presses the bulb portion 158 of the wall member 154. The increase in pressure caused by this pressing caused the water to rupture the membrane 160 and therefore allows the

water to mix with the ammonium nitrate. As with the previous embodiments this causes an endothermic reaction which draws heat from the beverage contained in the can. The speed of the reaction can be increased by the user repeatedly pressing/squeezing the bulb which agitates the water/ammonium nitrate mixture.

Figures 10 and 11 show a mechanism containing a rack and pawl mechanism having an inner member 196 and an outer member 198. Again there is a can 200 with a cylindrical chamber 202 dependent from a lower portion of the can 200. Two support structures 204, 206 are provided from the walls of the cylindrical member 202 which guide the rack and pawl mechanism. Looking at the Figures a membrane, or bag means 208, containing a quantity of water, is provided above the uppermost support member 204.

A diaphragm, or activation means, 210 is provided on a bottom end face 212 of the can 200 which engages the inner member 196 of the rack and pawl mechanism.

A quantity of ammonium nitrate 214 is provided between the two support members 204, 206 which is kept separated from the water by the bag means 208.

In use, a user repeatedly presses the diaphragm 210 to activate the cooling means. This forces an upward motion of the rack and pawl mechanism, one way barbs on the inner member 196 cause the outer member to also move in an upwards direction. However, friction of the outer member 198 prevents it from readily moving in a downwards direction. The inner member 196 moves down and the one way barbs

cause a relative displacement between the inner and outer members 196, 198.

This relative displacement moves the outer member 198 away from the lower portion of the can 200 and towards the bag means 208. Eventually the bag means 208 bursts releasing the water therein which mixes with the ammonium nitrate and starts the endothermic dissolution process which cools the beverage within the can 200.

Further movement of the diaphragm 210 causes the outer member 198 to continue to move in an upwards motion and ensure that the water is effectively squeezed from the bag means 208 by squeezing the bag means against the cylindrical container.

Figures 13 and 14 also have a can 250 and a cylindrical member 252 dependent from a lower portion of the can 250. There is provided a piston 254 within the cylindrical chamber 252. A disc portion 256 is at a central region of the cylindrical chamber 252. The disc portion 256 is of such a diameter that a narrow annular membrane 258 is provided from the disc portion 256 to the wall of the cylindrical chamber 252.

The combination of the disc portion 256 and the annular membrane 258 effectively split the cylindrical chamber into an upper 260 and a lower portion 262. The upper portion 260 contains water and the lower portion 262 contains ammonium nitrate.

A support means 264 a disc with an opening at a central portion receiving a rod 266 of the piston 254 is provided in a lower region of the

can 250. A diaphragm 268 (or activation means) is provided on the lower most end portion of the circular chamber 252 and acts upon the rod 266.

In use, a user presses the diaphragm 268. This pressure is passed through the rod 266 to the disc portion 256 causing the annular membrane 258 to rupture. Such rupture allows the water and the ammonium nitrate to mix starting the endothermic dissolution process which cools the contents of the can 200.

The user repeatedly presses the diaphragm which moves the piston 254 imparting turbulence into the water and ammonium nitrate mixture. This turbulence increases the rate at which the reaction proceeds and cools the can faster. The piston 254 is now acting as an agitation means.

The embodiment of Figures 15 and 16 is similar to that of Figures 13 and 14 with some additions and therefore like reference numerals have been used. There is no support means provided. However, there is an extra, dedicated, agitation means 270 provided which effectively comprises a second rod 272 (effectively an extension of the first rod 266) with a second disc member 274 connected to an end most portion.

As the skilled person will realise the ammonium nitrate and the water have been provided in the opposite portion to that in Figures 15 and 16. That is the ammonium nitrate is provided in the upper portion 260 and the water is provided in the lower portion 262.

The cooling means is activated in a similar way to the embodiment shown in Figures 13 and 14 but the dedicated agitation means ensures that the water and ammonium nitrate are more effectively mixed.

The embodiment shown in Figures 17 and 18 is similar to that shown in Figures 9 and 10 in that a bellows means 300 is provided. However, in this particular embodiment the bellows comprises a cylindrical walled vessel 302 in which the walls have been corrugated so that they are readily compressible. The upper most portions of the cylindrical walled vessel 302 are attached to a step 304 in the wall of a cylindrical chamber 306.

As with previous embodiments the cylindrical chamber 306 is divided into an upper portion 308 and a lower portion 310 separated by a membrane 312. In this embodiment ammonium nitrate is contained within the upper portion and water is contained within the bottom portion.

Within the bellows 300 there is provided a piston means 314 which in the un-acivated state of the cooling means is interposed between a bottom face of the bellows 300 and the membrane 312 with a disc portion 316 of the piston resting against the membrane 312.

Within the upper portion 308 of the cylindrical chamber 306 there is disposed an annular wall 318 of such dimensions that the opening is of such dimensions that it can slideably receive the disc portion 316 of the piston 314. In the wall of the annular wall 318 there are provided openings 320 (the openings may be thought of as turbulence inducing means in a wall member which is in a fixed relationship to the cooling chamber) connecting the inside of the annular wall 318 to the outside.

In use, as with the embodiment shown in Figures 9 and 10 the user presses the bellows to activate the cooling means. However, in this embodiment this does not only cause an increase in pressure within the water but also causes the piston 314 to rupture the membrane 312 thus allowing the water and the ammonium nitrate to mix.

As the piston 314 moves within slides within the annular wall 318 matter is expelled through the openings 320. This adds to mixing of the ammonium nitrate and water again increasing the rate at which the contents of the can are cooled.

In the embodiment shown in Figures 19 and 20 a piston 350 is provided connected via a frangible joint 352 connecting a disc portion 354 of the piston 350 to a container means 356. The ammonium nitrate is contained within the container means 356 and prevented from mixing with a quantity of water by the frangible joint.

A handle 358, activation means, which may be folded flat, is attached to a bottom end portion of the piston 350.

In use, a user would unfold the handle 358 and pull or push it, thus moving the piston 350 breaking the frangible joint 352 causing the water and ammonium nitrate to mix. The user may continue to move the piston by use of the handle and cause the piston 350 to act as an agitation means mixing the ammonium nitrate and water.

The skilled person will realise that many of the features in the embodiments so far described are applicable to other embodiments. For example the foldable handle 358 of Figures 19 and 20 could be used on any of the other embodiments. Another example of a transferable feature

would be the piston and frangible joint arrangement also of Figures 19 and 20 which could equally well be applied to other embodiments. The skilled person will realise other such features within the embodiments shown.

The embodiment shown in Figures 21 and 22 is somewhat different to those shown in the previous embodiments; there is no activation means external to the can.

Again a cylindrical chamber 400 is provided depending from a lower end portion of the can 402. There is no opening through the can 402 and the chamber 400 can be provided in a standard can. Within the cylindrical chamber 400 there is provided a sub-container 404 which has an opening 406 at a first end closed by a soluble seal.

Within the sub-container there is a quantity of ammonium nitrate and within the chamber 400, partially surrounding the sub-container there is a quantity of water. It will be noted that when the can is upright (i.e. Figure 21) there is a portion of the chamber 408 which does not contain any water which ensures that no water contacts the soluble seal.

To operate the cooling mechanism a user inverts the can 402 (as shown in Figure 22) which allows the water to contact the soluble seal and dissolve or rupture the seal. The water and ammonium nitrate are then free to mix and the cooling endothermic reaction can proceed.

The walls of any of the cylindrical chambers of the previous embodiments could be provided as corrugated cylinders (or heat transfer means) as shown in plan view in Figure 23. A cross section of a can 452 with such a cylinder in place is shown schematically in Figure 24.

Figures 25 to 32 show an embodiments which again do not have an internal activation means and so can be used in a standard can with no modifications. A stand alone cartridge 500 is provided which is inserted in a can 502. The cartridge 500 comprises a cylindrical vessel which is sealed by a diaphragm 504.

At a central portion of the vessel a membrane 505 divides the vessel 500 into a first 506 and second 508 portion. A quantity of water is maintained in the first portion and a quantity of water is maintained in the second portion. The membrane of course ensures that the two chemicals do not mix.

Depending from the diaphragm 504 pointing toward the membrane is a diaphragm interconnection means 510 comprising two resilient fingers each with a barb member 512 at an end portion. Secured to the membrane is a membrane interconnection means 514 also comprising two resilient fingers with barb members 516 at end portions.

As shown in Figure 25 the cartridge 500 is in an unactivated state and the barb members of the two interconnection means are not connected. The cartridge 500 is in this condition when it is inserted into the can 502.

In the next stage in the production process, the can 502 is filled with a carbonated beverage and sealed by a cap 518. Due to carbonisation of the of the beverage the inside of the can 502 is now partially pressurised. Thus the diaphragm 504 has a pressure exerted upon it and is caused to move towards the membrane 505 in turn causing the two interconnection means to come into contact. This is shown in Figure 26.

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The next stage in the can production process is the pasteurisation of the can in which the can is heated. This heating causes the pressure inside the can to rise forcing the diaphragm 504 further toward the membrane 505 this in turn causes the barb members 512, 516 to pass each other. This is shown in Figure 27.

Once pressure in the can 502 has returned to normal, as shown in Figure 28, the interconnection means 510, 514 remain in contact due to the barb members 512, 516.

Activation of the cooling means is achieved once the can is opened, as shown in Figure 29. Activating a ring pull 518 of the can releases the pressure within the can causing the diaphragm 504 to move to its original, uncompressed, position as in Figure 25. Because the interconnection means are now connected the membrane 505 ruptures allowing the two chemicals within (in this case water and ammonium nitrate) to mix and the cooling process to start.

Figure 30 is an enlarged version of Figure 28 showing the barb means more clearly.

Figures 31 and 32 also show an embodiment which is armed by the pasteurisation process. However, some of the features from the earlier embodiments have now been included. For instance a piston 600 has been provided to cause some agitation of the two chemicals as the can is opened. Also a frangible joint 602 is used to ensure that the two chemicals do not mix before activation. Openings 604 have been provided in an annular wall member 606 to provide a flow path for the water as the piston 600 moves upwards (as illustrated in Figure 32).

In a further embodiment which is not illustrated a can is provided in which at least one pair of Peltier plates are provided. That is a plates involving the use of dissimilar metals which when a current is passed through them cause a cooling effect. (This is the thermocouple effect in reverse).

The plates may be in contact with the beverage, or foodstuff, which ensures a good thermal contact with the beverage, or foodstuff, and thus good cooling. Alternatively, the plates may be provided in a cooling chamber, the outside of which is in contact with the beverage or foodstuff.

A small battery is provided in a recess in the bottom of the can with wires connected to the plates. A small push button switch is provided on a bottom end face portion of the can and is connected in one of the wires between the positive terminal of the battery and the plates.

In use, to activate the cooling means the user presses the button. This causes a current to flow from the battery, through the plates, and thus cools the beverage. As with any of the other examples, the user leaves the can for a short while to ensure that the beverage therein is effectively cooled and can then open the can in the usual way to consume the beverage.

The skilled person will realise that many of the Figures are provided in pairs with the first drawing of each pair showing the cooling means un-activated and the second Figure showing the cooling means after activation.

CLAIMS

1. A beverage, or other foodstuff, container which is provided with a cooling means adapted, in use, to chill a beverage, or foodstuff, contained within the container.

2. A container according to claim 1 which is a can.

3. A container according to claim 1 or claim 2 which uses an endothermic dissolving or dissolution of a first chemical into a second chemical to achieve cooling.

4. A container according to claim 3 in which the first chemical is ammonium nitrate.

5. A container according to claim 3 or claim 4 in which the second chemical is water.

6. A container according to any preceding claim in which a cooling chamber is provided which contains the cooling means so as to maintain the cooling means separate from the beverage or foodstuff contained within the container.

7. A container according to claim 6 in which the cooling chamber is provided in association with the outside of the container.

8. A container according to claim 6 in which the cooling chamber is provided within the container.

9. A container according to claim 8 in which the cooling chamber is provided as a cylindrical chamber.

10. A container according to claim 8 or claim 9 in which the cooling chamber is provided as blind bore integrally formed in the lower end portion of the container.

11. A container according to any preceding claim in which an internal activation means is provided which operates when the beverage or foodstuff container is opened.

12. A container according to claim 11 in which the activation means is operated by a drop in pressure as the container is opened.

13. A container according to claim 1 to 10 in which an external activation means is provided on the container to activate the cooling means.

14. A container according to any preceding claim in which the activation means causes a membrane, divider, partition, bag, or other such device (hereinafter referred to as a membrane) to rupture.

15. A container according to claim 14 in which the membrane comprises a burstable bag, or other similar volume containing structure.

16. A container according to claim 14 or claim 15 in which the membrane is ruptured by a sharp barb, blade, or other similar structure.

17. A container according to claim 14 or claim 15 in which the membrane has a frangible joint which is caused to break.

18. A container according to claim 14 or 15 in which the membrane is ruptured by a screw or other such helical device.

19. A container according to claim 14 or claim 15 as they depend from claim 6 in which a component of the cooling chamber (or in the cooling chamber) is pulled or pushed against a disruption element to break the membrane.

20. A container according to claim 14 or claim 15 in which a soluble membrane is provided which dissolves.

21. A container according to claim 14 or claim 15 in which the membrane means comprises at least two plates, axially aligned, next to one another, each of which contains at least one hole or passage.

22. A container according to claim 21 in which in an unactivated state the holes or passages are unaligned.

23. A container according to claim 21 or 22 in which alignment, in use, of the holes, or passages, equates to failure of membrane and allows matter to pass.

24. A container according to any of claims 16 to 23 as they depend from claim 3 in which the membrane separates the two chemicals.

25. A container according to any of claims 11 to 13 in which failure of the membrane or alignment of the holes or passages is caused by activation of the activation means.

26. A container according to claim 11 to 13 or claim 26 in which the activation means is a bellows.

27. A container according to claims 11 to 13 or claim 26 in which the activation means is a plunger.

28. A container according to claims 11 to 13 or claim 26 in which the activation means is a switch.

29. A container according to any preceding claim in which an agitation means is provided.

30. A container according to claim 29 as it depends from claim 3 or claim 24 in which the agitation means ensures that the first and second chemicals are properly mixed.

31. A container according to claim 30 in which the agitation means comprises vanes, which are in contact with the first and second chemicals.

32. A container according to claim 31 in which the vanes are adapted to move about an axis of rotation.

33. A container according to claim 30 in which the agitation means comprises a member, e.g. a perforated plate, which as it is moved through the first and second chemicals causes agitation.

34. A container according to claim 30 in which the agitation means comprises a means powered from an external source.

35. A container according to claim 34 in which the agitation means is an electric motor connected to a vaned member or other such impeller or stirring means.

36. A container according to claim 34 in which the agitation means is an electric pump.

37. A container according to any of claims 34 to 36 in which the power source is a battery.

38. A container according to any of claim 34 to 36 in which the power source is a solar cell.

39. A container according to claim 3 or claim 24 in which a turbulence inducing means is provided.

40. A container according to claim 39 in which the turbulence inducing means comprises holes, ducts, openings, etc. in a member.

41. A container according to claim 40 in which the member is a wall member.

42. A container according to claim 3 or 24 in which a bellows means are provided which are adapted, in use, to cause turbulence within the first and second chemicals.

43. A container according to claim 42 in which the bellows means comprise a bulb of resilient material.

44. A container according to claim 1 in which the cooling means comprises a Peltier effect cooling system.

45. A container according to claim 1 in which the cooling means comprises the use of evaporation of water to provide the cooling effect.

46. A container according to claim 45 in which the evaporation of the water is vacuum driven.

47. A container according to claim 45 or 46 in which a desiccant material is used to facilitate the evaporation.

48. A container according to claim 47 in which the desiccant is calcium sulphate, or silica gel, or low density silica gel, or a zeolite.

49. A container according to claim 1 in which the cooling means utilises the heat absorbed to evaporate a volatile liquid or indeed the boiling of (or expansion of) a compressed gas.

50. A container according to claim 49 in which the gas is butane, propane, carbon dioxide, a hydrofluorocarbon (HFC), nitrogen, dimethyl ether, or other suitable refrigerant gas.

51. A container according to claim 49 to 50 in which a vortex tube means is used to restrict the rate at which the gas boils by restricting the rate at which the gas escapes to the atmosphere.

52. A container according to any of claims 49 to 51 in which a pressuriseable container capable of maintaining the gas or the liquid under pressure provided to hold the gas or liquid.

53. A container according to claim 52 in which the pressuriseable container is provided as a recyclable unit which is inserted into a can to allow the can to perform its self cooling function.

54. A container according to any preceding claim in which a heat transfer means is provided to ensure that more efficient heat transfer occurs between the cooling means and the beverage, or foodstuff, contained in the container.

55. A container according to claim 54 in which the heat transfer means comprises a cylinder with corrugated or grooved walls.

56. A container according to claims 54 or 55 in which the heat transfer means is fabricated from a metal.

57. A container according to claims 54 to 56 as they depend from claim 6 in which the heat transfer means is the cooling chamber.

58. A container according to any preceding claim in which insulation is provided.

59. A container according to any preceding claim in which the container is adapted to be recycled once the container has been used.

60. A container according to claim 59 in which the container contains only (or substantially only) materials which are readily recyclable.

61. A container according to any preceding claim in which the container is adapted, in use, to reduce the temperature of its contents by substantially between 5° and 19°C.

62. A container according to claim 61 in which the temperature reduction is substantially between 9° and 15°C.

63. A container according to claim 61 or 62 in which the temperature of its contents is reduced substantially by at least 12°C.

64. A container according to any preceding claim in which the contents of the container are cooled to substantially between 4°C and 10°C.

65. A container according to claim 64 in which the contents of the container are cooled to substantially between 6°C and 8°C.

66. A container according to any preceding claim in which the cooling of the contents takes place in substantially 30 seconds, or 45 seconds, or 60 seconds, or 75 seconds, or 90 seconds, or 120 seconds or 180 seconds, or any intermediate time between these time periods.

67. A container according to any preceding claim in which the volume of beverage or foodstuff which can be held within the container is substantially 330ml.

68. A method of cooling a beverage or foodstuff container.

69. A method of cooling a beverage or foodstuff container according to claim 68 which uses an endothermic dissolution process.

70. A method according to claim 68 or 69 which relies on the Peltier effect.

71. A method according to claims 68 to 70 which uses the evaporation of water or other liquid, or the evaporation of a volatile liquid.

72. A method according to any of claims 68 to 71 which uses the boiling of a compressed gas.

73. A method according to claim 68 or 69 which mixes a first and a second chemical to cool the contends of the container.

74. A method according to claim 73 in which the first chemical is water.

75. A method according to claim 73 to 74 in which the second chemical is ammonium nitrate.

76. A method according to claim 72 in which the gas is butane, or propane, or carbon dioxide, or nitrogen, or dimethyl ether, or an HFC.

77. An insert for a beverage, or foodstuff container which, in use, cools the contents of the container.

78. An insert according to claim 77 which has any of the features claimed in claims 1 to 69.

79. A beverage, or foodstuff container, which has been filled with a beverage or foodstuff and also filled with an insert according to claim 77 or 78.

80. A container for a beverage or foodstuff substantially as described herein.

81. A method of cooling a beverage or foodstuff within a container substantially as described herein.

82. An insert for a container substantially as described herein.

83. A filled foodstuff or beverage container including an insert substantially as described herein.

The Patent Office

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Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): F4H (H3, H7, HG9)

Int Cl (Ed.6): F25D (5/02)

Other: ONLINE DATABASE:WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2261501 A	KIN-SHEN HUANG Consider whole document; stirring device (6).	1-3,6,8,9, 29,68, 69,77 at least
X	GB 1455188	SATO Consider whole document; needle member (23).	1-3,6,8,9, 58,68, 69,77 at least
X	GB 1451217	READI TEMP Consider whole document.	1-3,6,7,9, 68,69 at least
X	WO 85/02009 A1	GEMCONTACT Consider whole document; water-ammonium nitrate.	1-6,8,9, 68,69,73-75,77 at least
X	EP 0297724 A2	THE COCA-COLA COMPANY Consider whole document; see especially ll.29-36 col 3.	1-6,8,9,54, 56,68,69, 73-75,77 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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The Patent Office

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Claims searched: All

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Category	Identity of document and relevant passage		Relevant to claims
X	EP 0286382 A2	THE COCA-COLA COMPANY Consider whole document; see especially ll.1-2 col 5.	1-6,8,9,29, 58,68,69, 73-75,77 at least
X	US 5163504	JOSEPH A RESNICK See especially Fig.2a; ll.54-57 col 1.	1-7,68,69, 73-75 at least
X	US 4993237	HERITAGE VENTURES Consider whole document; see 1.32 col 3.	1-6,8,9, 54,68,69, 73-75,77 at least
X	US 4816048	MICHAEL J KIMMELSHUE Consider whole document; see especially ll.50-52 col 1.	1-6,8,9, 68,69,73-73,77 at least
X	US 4751119	MURAJIROH UKON Consider whole document; see especially ll.51-53 col 6.	1-6,8,9, 68,69,73-75,77 at least
X	US 3874557	HAROLD E PORTER Consider whole document; see especially ll.8-9 col 2.	1-6,8,9, 54,68,69, 73-75,77 at least

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